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GAS CHROMATOGRAPHIC DETERMINATION
OF THE WATER IN CIGARETTE MAIN-
STREAM SMOKE AND TOTAL PARTICULATE
MATTER.

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ABSTRACT

A method has been developed for determining the total water content of cigarette smoke and of cigarette filter media. Pyridine was employed as a water-absorbing solvent, the water content of the pyridine being measured by gas chromatography before and after contact with the smoke or filter media. The water has been determined in the mainstream smoke of burley, flue-cured, Turkish and blended tobacco rods. The mainstream water content has also been determined for blended tobacco rods with and without cellulose acetate filters. For the above samples, the water content of the total particulate matter (T.P.M.) of the smoke was also determined using the same gas chromatographic technique. The T.P.M. was considered that part of the smoke which was collected on a Cambridge filter mat positioned directly behind the cigarette. Data are presented showing the total water content of the mainstream smoke of filtered cigarettes after they had been conditioned to tobacco moisture levels ranging from 0.7% to 16.6%.

REVIEW BY W. J. NEDLOCK

The procedure followed for determining the water content of mainstream smoke is to smoke five cigarettes into a trap, using a Bradford falling water smoking machine. The smoke is bubbled through pyridine contained in a trap and through two scrub traps. The equipment is dismantled and washed with the pyridine from one scrub trap. The pyridine is then transferred to a 50 ml. volumetric flask, brought to volume, and capped with a septum.

The author emphasized that the reasons for using pyridine were its hygroscopic properties, its non-water producing effect in reaction with smoke, its infinite resolution, and its enhanced peak height in relation to the concentration of pyridine applied to the Chromatograph.

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Water content is determined chromatographically using a constant volume injection technique. The chromatograph is a Perkin-Elmer 150, and the column is a 1/4" by 4' copper tube packed with 50/80 bylapate H. The water content is determined from peak height, which gives a linear relationship with weight of water present in the pyridine.

The water content in TPM is determined by smoking five cigarettes on a Cambridge filter pad and extracting the pad for 15 to 20 minutes in 10 ml. of pyridine.

The total water content of cigarette mainstream smoke for a number of blends is given in Table 1, and the water in the TPM of cigarettes of blended tobaccos is given in Table 2. Table 3 shows water in mainstream smoke and TPM as a function of moisture content of tobacco.

TABLE 1

TOTAL WATER IN CIGARETTE MAINSTREAM SMOKE

<u>Cigarette Sample</u>	<u>Description of Rod and Filter</u>	<u>Total H₂O mg/5 cig</u>	<u>H₂O mg/cig</u>
A - Blended Tobacco	70 mm rod	32.0-41.0*	7.4-8.2*
	15 mm acetate filter	39.5**	7.9**
B - Blended Tobacco	70 mm tobacco rod	54.5-63.5	10.9-12.7
		59.5	11.9
C - Blended Tobacco	85 mm tobacco rod	45.4-48.0	9.2-9.6
		47.5	9.5
D - Blended Tobacco	80 mm tobacco rod	42.5-43.5	8.5-8.7
		43	8.6
E - Blended Tobacco	10 mm acetate filter		
	10 mm bonded carbon filter	33.5-36.0	6.7-7.2
	65 mm tobacco rod	34.0	6.8
Flue-cured	70 mm tobacco rod	68-86	15.6-17.2
		81.5	16.3
Burley	70 mm tobacco rod	46.3-49.0	9.3-9.8
		47.5	9.5
Turkish	70 mm tobacco rod	73-73.5	14.6-14.7
		73.3	14.6
Cellulose	70 mm rods	68-81	13.6-16.0
		74.7	14.9

* range ** average

TABLE II

WATER IN TPM OF CIGARETTES OF BLENDED TOBACCO AND TOBACCO TYPES

Sample Description	Butt Length After Smoking	mg H ₂ O in TPM/cig	mg TPM per cig	% H ₂ O in TPM/cig	% of Total H ₂ O in TPM
A - 85 mm Blended Tobacco Rod	35 mm	2.1	26.6	7.9	25.3
B - 70 mm Blended Tobacco Rod	20 mm	2.7	30.4	8.8	22.7
C - 80 mm Blended Tobacco Rod	30 mm	2.0	23.4	8.5	23.3
D - 70 mm Tobacco Rod 15 mm Acetate filter	35 mm	1.8	18.2	9.9	23
Burley Rod - 70 mm	20 mm	2.7	24.9	11	28.5
Flue-cured Rod - 70 mm	20 mm	3.0	33.1	9.1	
Turkish Rod - 70 mm	20 mm	2.4	27.5	9.0	16.4

TABLE III

WATER IN CIGARETTE* MAINSTREAM SMOKE AND TPM AS A FUNCTION OF MOISTURE CONTENT OF TOBACCO

Percent Moisture in Tobacco	Total Mainstream Smoke Water, mg/cig	Water in Cigarette TPM, mg/cig	Percent of Total Water in TPM	Water in TPM as Percent of TPM
0.7	3.3	0.5	15.0	2.9
5.5	4.9	0.8	16.3	4.2
8.0	5.6	0.9	16.0	5.7
9.1	6.1	1.1	18.0	6.6
13.4	7.8	1.7	21.8	8.9
16.4	9.6	2.2	23.0	10.9

* 70 mm Rod with 15 mm acetate filter